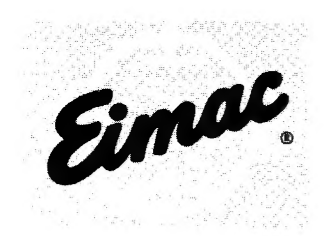


E I M A C

Division of Varian

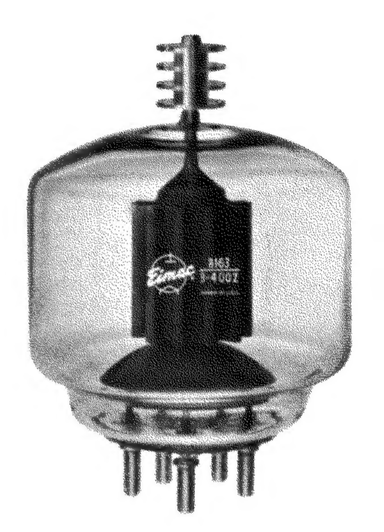
SAN CARLOS

CALIFORNIA

8163
3-400Z

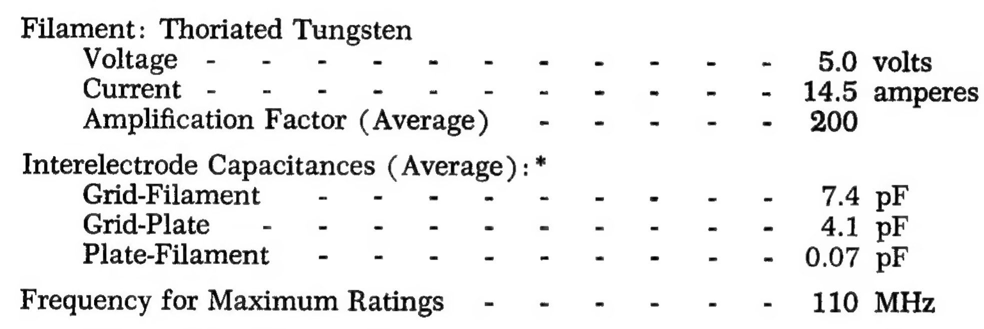
HIGH-MU POWER TRIODE

The EIMAC 8163/3-400Z is a compact power triode intended to be used as a zero-bias Class-B amplifier in audio or radio-frequency applications. Operation with zero grid bias simplifies associated circuitry by eliminating the bias supply. In addition, grounded-grid operation is attractive since a power gain as high as twenty times can be obtained with the 8163/3-400Z in a cathode-driven circuit.



GENERAL CHARACTERISTICS

ELECTRICAL



Filament: Thoriated Tungsten

Voltage	5.0 volts
Current	14.5 amperes
Amplification Factor (Average)	200

Interelectrode Capacitances (Average):*

Grid-Filament	7.4 pF
Grid-Plate	4.1 pF
Plate-Filament	0.07 pF

Frequency for Maximum Ratings	110 MHz

MECHANICAL

Base	5 Pin Special
Basing	See Drawing
Mounting Position	Vertical, base down or up
Cooling	Radiation and Forced Air
Heat-Dissipating Plate Connector	Supplied mounted on tube
Recommended Socket	EIMAC SK-410
Recommended Chimney	EIMAC SK-416

Maximum Operating Temperatures:

Plate Seal	225°C
Base Seals	200°C

Maximum Over-all Dimensions:

Height	5.25 inches
Diameter	3.57 inches

Net Weight	7 ounces

*In Shielded Fixture

Printed in U.S.A.

R-F LINEAR AMPLIFIER GROUNDED-GRID, CLASS-B

MAXIMUM RATINGS

DC PLATE VOLTAGE	3000 VOLTS
DC PLATE CURRENT	0.400 AMP
PLATE DISSIPATION	400 WATTS
GRID DISSIPATION	20 WATTS

TYPICAL OPERATION (Single-Tone Conditions)

DC Plate Voltage	3000 volts
Zero-Sig DC Plate Current*	100 ma
Max-Sig DC Plate Current	333 ma
Max-Sig DC Grid Current	120 ma
Driving Impedance	122 ohms
Resonant Load Impedance	4750 ohms
Max-Sig Driving Power	32 watts
Peak Envelope Plate Output Power	655 watts

TYPICAL OPERATION (Minimum Distortion Products)

DC Plate Voltage	2000 volts
Zero-Sig DC Plate Current*	62 ma
Single-Tone DC Plate Current	400 ma
Single-Tone DC Grid Current	148 ma
Two-Tone DC Plate Current	265 ma
Two-Tone DC Grid Current	87 ma
Peak Envelope Useful Output Power	445 watts
Resonant Load Impedance	2750 ohms
Intermodulation Distortion Products	—40 db

TYPICAL OPERATION (Minimum Distortion Products at 1 KW PEP Input)

DC Plate Voltage	2500 volts
Zero-Sig DC Plate Current*	73 ma
Single-Tone DC Plate Current	400 ma
Single-Tone DC Grid Current	142 ma
Two-Tone DC Plate Current	274 ma
Two-Tone DC Grid Current	82 ma
Peak Envelope Useful Output Power	560 watts
Resonant Load Impedance	3450 ohms
Intermodulation Distortion Products	—35 db

TYPICAL OPERATION (Minimum Distortion Products at 1500 Volts Plate Voltage)

DC Plate Voltage	1500 volts
Zero-Sig DC Plate Current*	46 ma
Single-Tone DC Plate Current	400 ma
Single-Tone DC Grid Current	163 ma
Two-Tone DC Plate Current	265 ma
Two-Tone DC Grid Current	92 ma
Peak Envelope Useful Output Power	300 watts
Resonant Load Impedance	1620 ohms
Intermodulation Distortion Products	—37 db

A-F AMPLIFIER OR MODULATOR, CLASS-B

MAXIMUM RATINGS (PER TUBE)

DC PLATE VOLTAGE	3000 VOLTS
DC PLATE CURRENT	0.400 AMP
PLATE DISSIPATION	400 WATTS
GRID DISSIPATION	20 WATTS

TYPICAL OPERATION (Sinusoidal Wave, Two Tubes, Grid Driven)

DC Plate Voltage	3000 volts
DC Grid Voltage	0 volts
Zero-Sig DC Plate Current*	200 ma
Max-Sig DC Plate Current	666 ma
Max-Sig DC Grid Current	240 ma
Driving Power	26 watts
Peak A-F Driving Voltage (per tube)	88 volts
Load Resistance, Plate-to-Plate	9500 ohms
Max-Sig Plate Output Power	1310 watts

R-F POWER AMPLIFIER OR OSCILLATOR, CLASS-C

MAXIMUM RATINGS

DC PLATE VOLTAGE	4000 VOLTS
DC PLATE CURRENT	0.350 AMP
PLATE DISSIPATION	400 WATTS
GRID DISSIPATION	20 WATTS

TYPICAL OPERATION

DC Plate Voltage	3000 volts
DC Plate Current	333 ma
DC Grid Voltage	—75 volts
DC Grid Current	130 ma
Peak R-F Grid Voltage	187 volts
Grid Driving Power	25 watts
Plate Output Power	730 watts

R-F POWER AMPLIFIER PLATE-MODULATED

MAXIMUM RATINGS

DC PLATE VOLTAGE	3000 VOLTS
DC PLATE CURRENT	0.275 AMP
PLATE DISSIPATION	270 WATTS
GRID DISSIPATION	20 WATTS

TYPICAL OPERATION

DC Plate Voltage	3000 volts
DC Plate Current	245 ma
DC Grid Voltage	—90 volts
DC Grid Current	100 ma
Peak R-F Grid Voltage	185 volts
Grid Driving Power	18 watts
Plate Output Power	550 watts

NOTE: In most cases, "TYPICAL OPERATION" data are obtained by calculation from published characteristic curves and confirmed by direct tests. No allowance for circuit losses, either input or output, has been made. Exceptions are distinguished by a listing of "Useful" output power as opposed to "Plate" output power. Values appearing in these groups have been obtained from existing equipment(s) and the output power is that measured at the load.

*Approximate Value

APPLICATION

Mounting — The 3-400Z must be operated vertically, base up or base down. A flexible connecting strap should be provided between the heat dissipating plate connector and the external plate circuit. The tube must be protected from severe vibration and shock.

Cooling — Forced-air cooling is required to maintain the base seals at a temperature below 200°C, and the plate seal at a temperature below 225°C. When using the EIMAC SK-410 Air-System Socket and SK-416 Chimney, a minimum air flow rate of 13 cubic feet per minute at a static pressure of approximately 0.13 inch of water at sea level is required to provide adequate cooling at an inlet air temperature of 55°C. At higher inlet air temperatures, higher altitudes, or at frequencies above 30 MHz, the air flow rate must be increased to give equivalent cooling. Cooling air must be supplied to the tube even when the filament alone is on during standby periods.

When a socket other than the SK-410 is used, provisions must be made for equivalent cooling of the base, the envelope, and the plate lead. In all cases, air flow rates in excess of the minimum requirements will prolong tube life.

Class-C Operation — Although specifically designed for class-B service, the 3-400Z may be operated as a class-C power amplifier or oscillator or as a plate-modulated radio-frequency power amplifier. The zero-bias characteristic of the 3-400Z can be used to advantage in class-C amplifiers operating at plate voltages of 3000 volts or below by employing only grid-leak bias. If driving power fails, plate dissipation is then kept to a low value because the tube will be operating at the normal static zero-bias conditions.

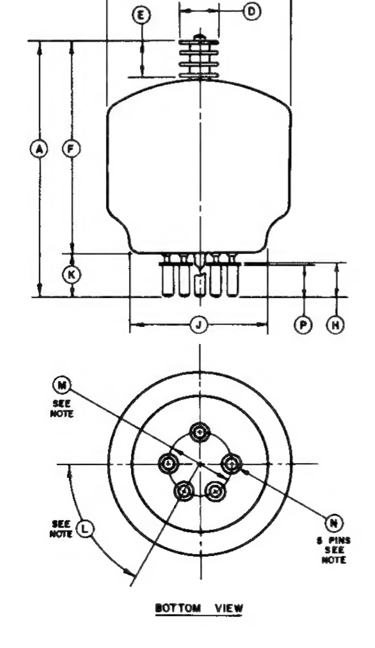
Filament Operation—The rated filament voltage for the 3-400Z is 5.0 volts. Filament voltage, as measured at the socket, must be maintained within the range of 4.75 to 5.25 volts to obtain maximum tube life.

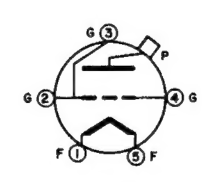
Intermodulation Distortion — Typical Operating conditions with distortion values included are the result of data taken during actual operation at 2 megahertz. Intermodulation values listed are those measured at the full peak envelope power noted. As the driving signal level is reduced, distortion products remain at the listed value, or better, below original peak envelope power level.

Input Circuit — When the 3-400Z is operated as a grounded-grid r-f amlpifier, the use of a resonant tank in the cathode circuit is recommended in order to obtain greatest linearity and power output. For best results with a single-ended amplifier it is suggested that the cathode tank circuit operate at a "Q" of five or more.

Special Applications—If it is desired to operate this tube under conditions widely different from those given here, write to Power Grid Tube Marketing, EIMAC, Division of Varian, 301 Industrial Way, San Carlos, California, for information and recommendations.

3-400Z OUTLINE DRAWING AND PIN CONNECTIONS

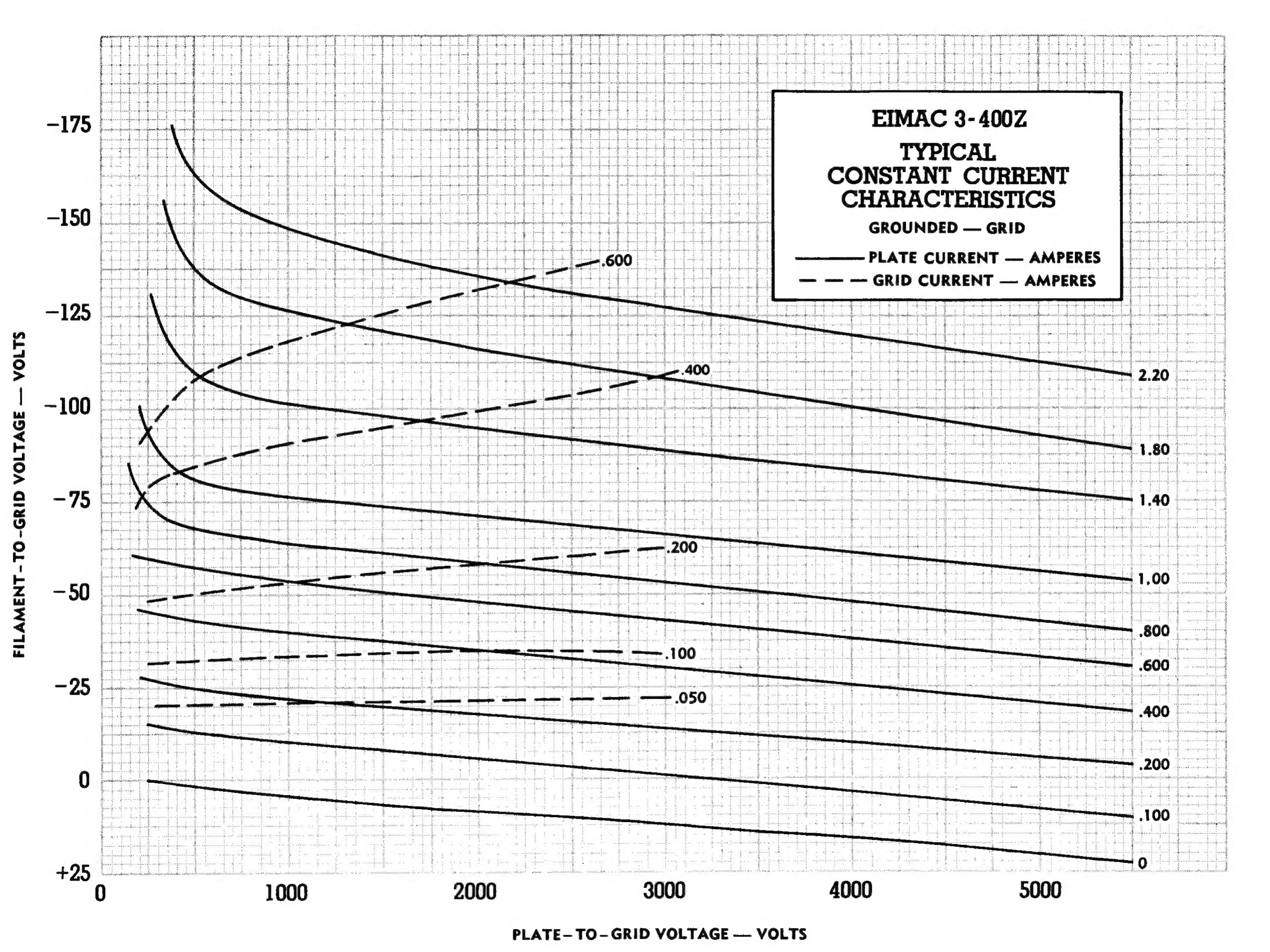




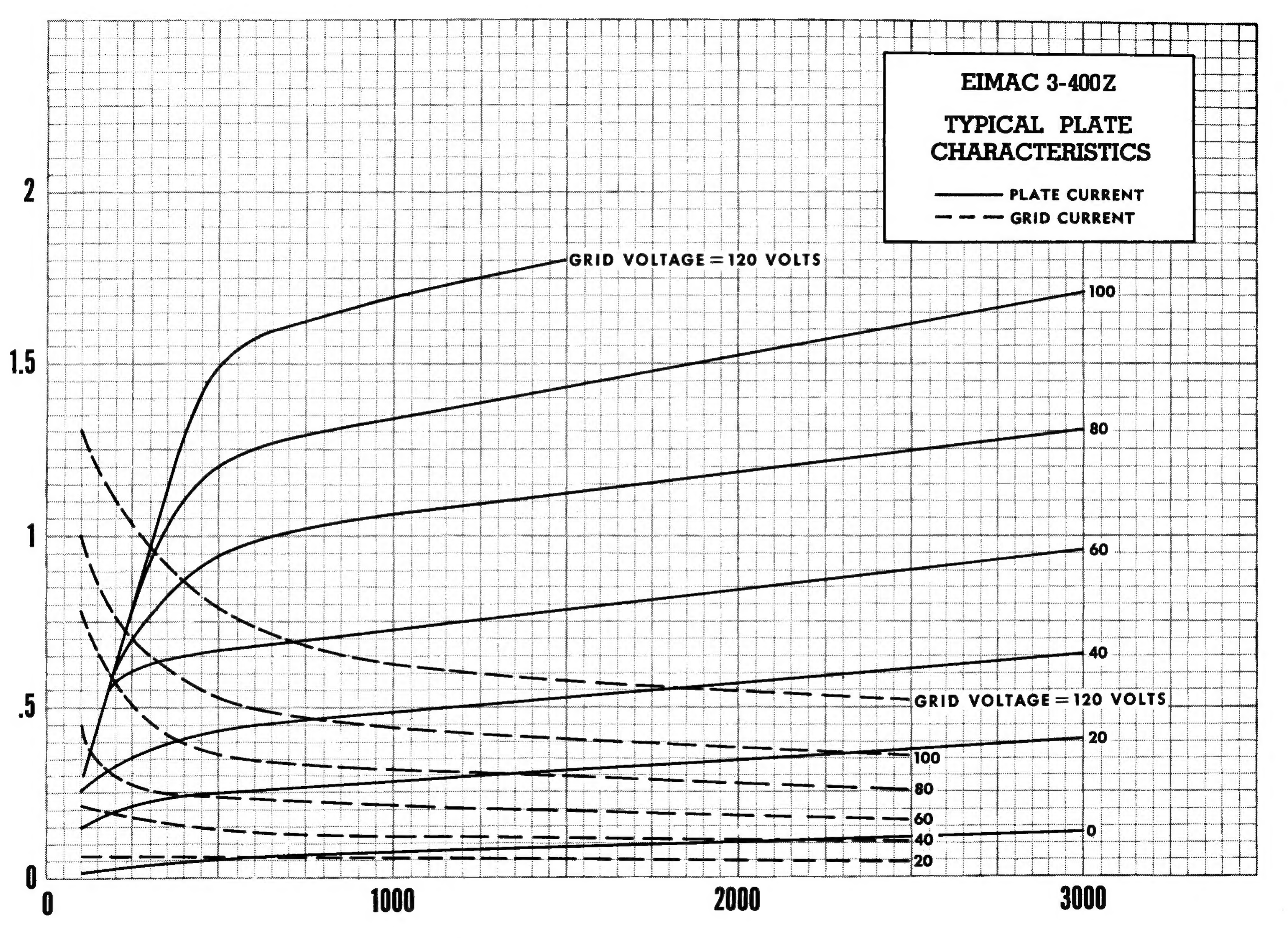
NOTE:
BASE PINS (N) ARE SO ALIGNED THAT THEY CAN BE FREELY INSERTED INTO A GAUGE 1/4" THICK WITH HOLE DIA'S. OF .204 LOCATED ON THE TRUE CENTERS BY THE GIVEN DIMS. (L) & (M).

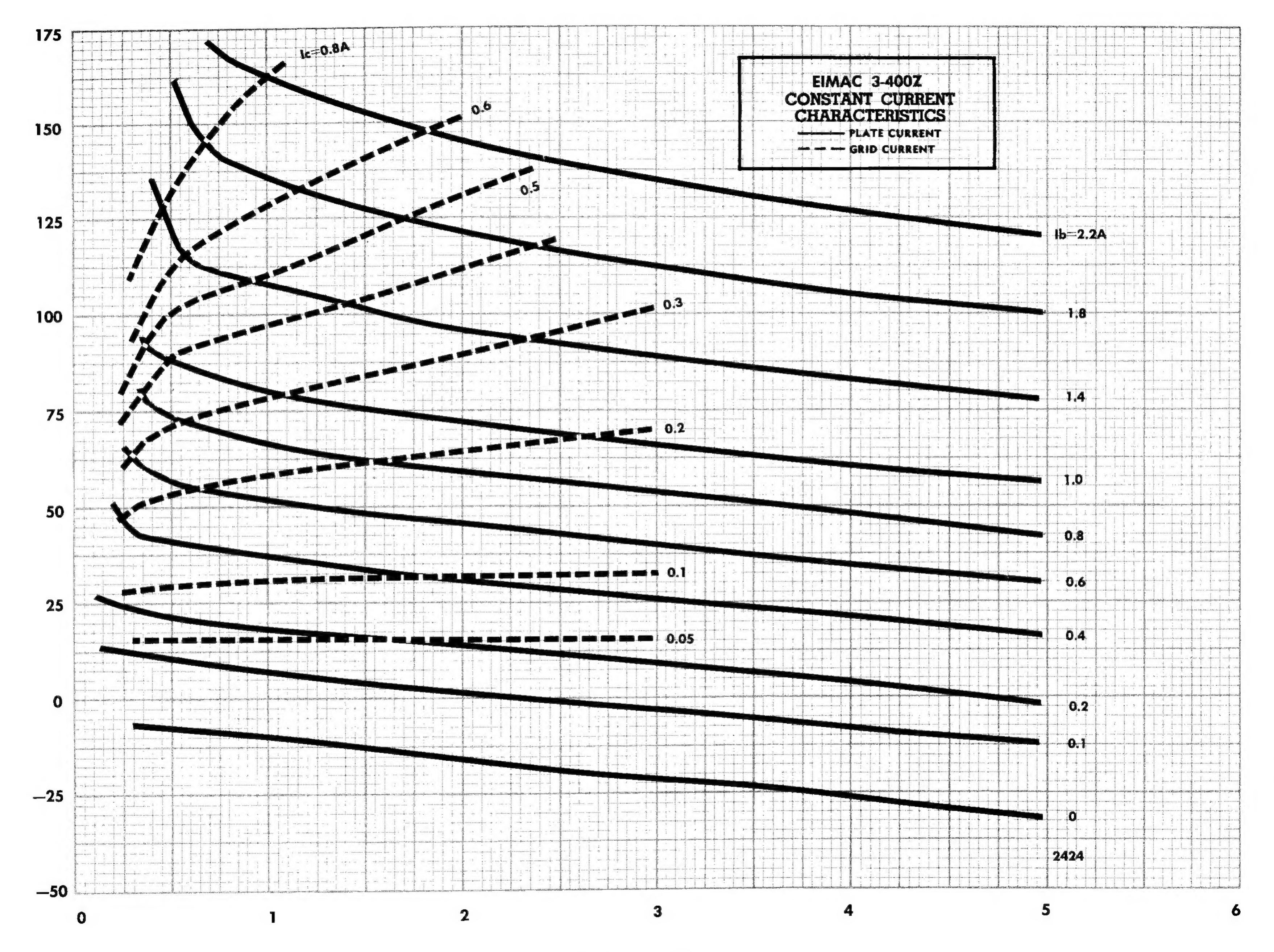
DIMENSIONS IN INCHES

DIMENSIONAL DATA			
REF.	MIN.	MAX.	NOM.
A	4-3/4	5-1/4	
B		3-9/16 D.	
D	.745 D.	.755 D.	
E	.640	.660	
F	3-15/16	4-7/16	
H	9/16	11/16	
J		2-1/2 D.	
K			13/16
L			60° TYP.
M			1-1/4 D. P.C.
N	.185 D.	.191 D.	
P	1/2	5/8	



EIMAC 3-400Z
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
GROUNDED — GRID
PLATE CURRENT — AMPERES
GRID CURRENT — AMPERES
.600
.400
.200
.100
.050
2.20
1.80
1.40
1.00
.800
.600
.400
.200
.100
0
FILAMENT–TO–GRID VOLTAGE — VOLTS
-175
-150
-125
-100
-75
-50
-25
0
+25
0
1000
2000
3000
4000
5000
PLATE–TO–GRID VOLTAGE — VOLTS


EIMAC 3-400Z
TYPICAL PLATE CHARACTERISTICS
PLATE CURRENT
GRID CURRENT
GRID VOLTAGE = 120 VOLTS
100
80
60
40
20
0
GRID VOLTAGE = 120 VOLTS
100
80
60
40
20
CURRENT—AMPERES
0
.5
1
1.5
2
PLATE VOLTAGE—VOLTS
0
1000
2000
3000


EIMAC 3-400Z
CONSTANT CURRENT
CHARACTERISTICS
PLATE CURRENT
GRID CURRENT
Ic=0.8A
0.6
0.5
0.3
0.2
0.1
0.05
Ib=2.2A
1.8
1.4
1.0
0.8
0.6
0.4
0.2
0.1
0
2424
Ec/VOLTS
175
150
125
100
75
50
25
0
−25
−50
Eb/KILOVOLTS
0
1
2
3
4
5
6